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"FIFI IMAGING OF FINE-STRUCTURE LINES IN THE NGC 6334 CLOUD COMPLEX"

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FIFI Imaging of Fine-Structure Lines in the NGC 6334 Cloud Complex

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The goal of this project was to observe and analyze the far infrared fine-structure line emission from 7 OB stars in the NGC 6334 cloud and to interpret the observations in terms of current theories of photodissociation regions.

The observations for this proposal have been successfully carried out in 2 flight series with the KAO in April August 1992. We imaged the 158 um [C II] line, the 145 um [O I] line, and the 63 um [O I] line throughout the complex. We were also able to detect CO 17-16 emission toward two of the OB stars.

The data have been calibrated and reduced, and we have produced images of the FIR line emission. In conjunction with our molecular line imaging of the cloud complex done at the Caltech Submillimeter Observatory, we have made the following conclusions:

1. In general, there is an anticorrelation of CO and [C II] emission. This suggests that the photodissociated gas lies in large, parsec-scale, embedded bubbles within the molecular cloud.

2. We have discovered for the first time a strong source of [C II] emission which is not associated with any known FIR or radio continuum source. This source is either (1) an embedded B star or star cluster which radiate enough soft UV photons to ionize carbon but not enough hard UV photons to ionize hydrogen, or (2) a ridge of photodissociated gas illuminated by a more distant O star.

3. The measured line ratios are incompatible with any current theory of photodissociation regions. The major problem is the faintness of the [O I] 63 um line, which is about a factor of 10 fainter than predicted. We suggest that self-absorption by cooler foreground material supresses the [O I] 63 um line.

The results of this study have been presented at a symposium, "Twenty-Five Years of Airborne Astronomy" in August 1994.

The remaining work before journal publication is

1. To incorporate molecular line and FIR continuum data into the PDR models.

2. To model the effects of a cool foreground cloud on the line ratios.

3. To determine the hardness of the UV field from radio continuum and FIR continuum data.

These tasks are now being carried by a graduate student, Kathleen Kraemer, who will incorporate these results into her PhD thesis. We expect to publish the KAO data within 6 months, and to publish the detailed PDR models based on these data within 1.5 years.